Endovascular stent infection

Michael K. Deiparine, MD, Jeffrey L. Ballard, MD, Frank C. Taylor, MD, and **Donald R. Chase, MD,** *Loma Linda, Calif.*

We report a case of iliac stent infection. Nine days after a 24-hour infusion of urokinase and right iliac artery stent deployment, the patient had fever, in addition to severe groin pain and petechiae isolated to the stented limb. The hospital course was complicated by sepsis, adult respiratory distress syndrome, liver dysfunction, and renal insufficiency. Stent removal and iliac/femoral artery resection, as well as an above-knee amputation, were life-saving. Arterial and stent cultures grew *Staphylococcus aureus.* Stent infection with arterial necrosis is a devastating, rare endovascular complication. Given its potential seriousness, we would recommend the use of prophylactic antibiotics before stent deployment. (J VASC SURG 1996;23:529-33.)

Endovascular techniques have become increasingly used in the treatment of peripheral vascular disease. Avoidance of a surgical procedure has been in large part a driving force in the development of balloon angioplasty and iliac artery stenting. However, there have been few reports outlining the potential complications that may arise from these endovascular procedures.[1,2] We present a case of iliac stent infection that resulted in substantial patient morbidity.

CASE REPORT

A 54-year-old white woman was seen in December 1994 with a 7-month history of progressive right foot ischemic rest pain and second-digit gangrene. Physical examination demonstrated a trace palpable right femoral pulse and Doppler signal over the right posterior tibial artery with an ankle/brachial index of 0.40. Examination of the left lower extremity demonstrated palpable femoral, popliteal, and posterior tibial pulses with an ankle/brachial index of 0.95. She had a significant smoking history but no history of heart disease, hypertension, or diabetes mellitus.

The patient had undergone several previous peripheral vascular procedures. In 1981 she had a right external iliac endarterectomy for claudication. In 1991 the patient underwent a femorofemoral bypass for recurrent claudication and right external iliac artery occlusion. In May 1993 she was seen with occlusion of the femorofemoral bypass and right foot rest pain. Aortography demonstrated severe stenosis of the distal left common iliac artery and origin occlusion of the right common iliac artery. There was collateral reconstitution of a severely narrowed right external iliac artery and origin occlusion of the right common femoral artery with collateral reconstitution of the superficial femoral and deep femoral arteries. At that time, the patient refused aortofemoral bypass. Instead, primary stenting with recanalization of the right common iliac and external iliac arteries was performed successfully, in addition to left common iliac artery and right common femoral artery angioplasty. This procedure restored normal in-flow to the femoral arteries. She was discharged uneventfully from the hospital the following day. There were bilateral palpable pedal pulses, and the right ankle/brachial index improved to 1.00.

The patient reported that right foot rest pain returned after approximately 12 months. Despite severe pain, she neglected to return to the vascular surgery clinic until December 1994. Once again the patient refused a surgical procedure to correct in-flow but would consent to a possible endovascular procedure. The arteriogram showed reocclusion of the stented right common and external iliac arteries, as well as occlusion of the proximal common femoral artery. A 24-hour urokinase infusion opened the occluded arteries. This was followed by angioplasty and restenting of the right common iliac artery and primary stenting of the proximal common femoral artery. The previously placed external iliac artery stent was reangioplastied as well. A completion angiogram demonstrated widely patent right common iliac, external iliac, and common femoral arteries (Fig. 1). In addition, she had chronic occlusion of the right superficial femoral artery, reconstitution of the above-knee popliteal artery, and

From the Divisions of Vascular Surgery and Interventional Radiology (Dr. Taylor) and the Department of Pathology (Dr. Chase), Loma Linda University Medical Center, Loma Linda.
Reprint requests: Jeffrey L. Ballard, MD, Division of Vascular Surgery, Loma Linda University Medical Center, Room No. 2586A, 11234 Anderson St., Loma Linda, CA 92354.

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Fig. 1. Completion arteriogram 24 hours after urokinase infusion, restenting of right common iliac artery and primary stenting of right common femoral artery.

three-vessel runoff. The patient's rest pain abated. She was discharged uneventfully with plans for a femoropopliteal bypass if claudication became disabling.

Nine days later, the patient was seen in the emergency department with complaints of severe right groin pain and a right lower extremity rash. The patient had a low-grade fever with a blood pressure of 95/54 mm Hg and heart rate of 100 beats/min. Right femoral and pedal pulses could not be palpated. The entire right lower extremity was covered with 1 to 2 mm erythematous petechial lesions. Laboratory examination demonstrated a protime value of 27.3 seconds (international normalized ratio, 5) without warfarin, a white blood cell count of 17.9 billion/L, and hemoglobulin level of 7.3 gm/dl. Blood cultures were positive for *Staphylococcus aureus.* Arteriography demonstrated occlusion of the right iliac artery throughout its stented portion with reconstitution of the common femoral artery.

Despite treatment with broad-spectrum antibiotics, the patient's condition deteriorated rapidly. She exhibited signs of overwhelming sepsis, adult respiratory distress syndrome, and renal insufficiency. Transesophageal echocardiography did not demonstrate evidence of bacterial endocarditis. The right iliac stents were presumed to be the source of sepsis and the lower extremity petechial rash was thought to represent septic emboli. Hemodynamic instability precluded iliac/femoral artery exploration and revascularization of the right lower extremity. The right leg continued to become increasingly ischemic and finally nonviable (Fig. 2).

On the third day of admission, when hemodynamically stable, the patient underwent right groin exploration. The common femoral artery was necrotic and the most distal stent was extruding out of the artery. The common femoral artery, distal stents, and distal one half of the femorofemoral bypass graft were resected and the profunda oversewn. The remaining proximal femorofemoral graft was noted to be well incorporated at the level of a mid-pubis cutdown. Exploration of the iliac fossa by a retroperitoneal approach demonstrated the external iliac artery and surrounding tissues to be severely inflamed. The external iliac artery and stents were resected, leaving behind the most proximal common iliac stent, and the proximal external iliac artery was ligated. A right above-knee amputation of the nonviable extremity followed the exploration.

Pathologic examination of the resected vessels demonstrated acute necrotizing arteritis with numerous bacterial colonies attached to the intima. The amputated right lower extremity demonstrated multiple septic petechiae that microscopically were associated with vascular thrombus, arteritis, and the presence of bacteria (Fig. 3). Bacterial cultures of the resected arteries and stents were positive for *S. aureus.* The groin wound cultures also grew *Escherichia coli,* which was also recovered from a sputum sample.

After surgery, the patient was treated with vancomycin and ciprofloxacin. However, she continued to have a rocky course in the intensive care unit with continued adult respiratory distress syndrome requiring tracheostomy, renal insufficiency, and sepsis. Nineteen days after right

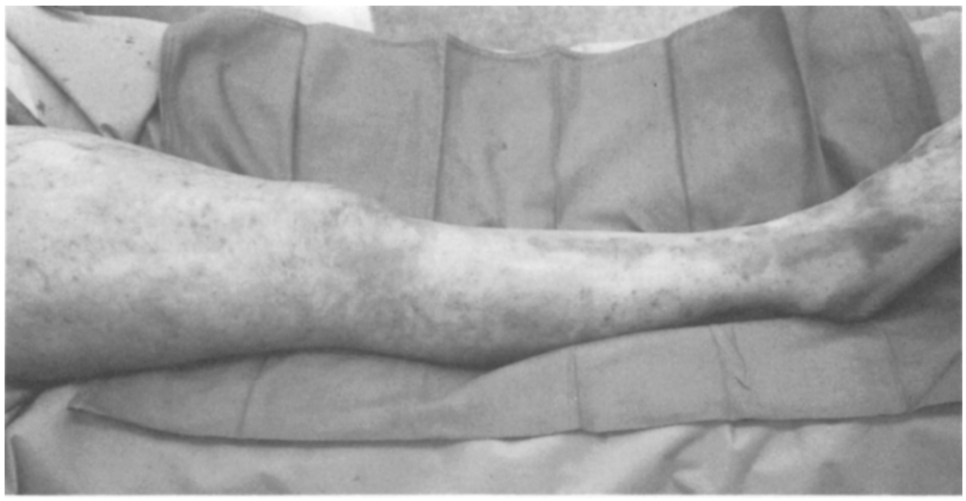

Fig. 2. Intraoperative photograph of ischemic right lower extremity with scattered petechial lesions.

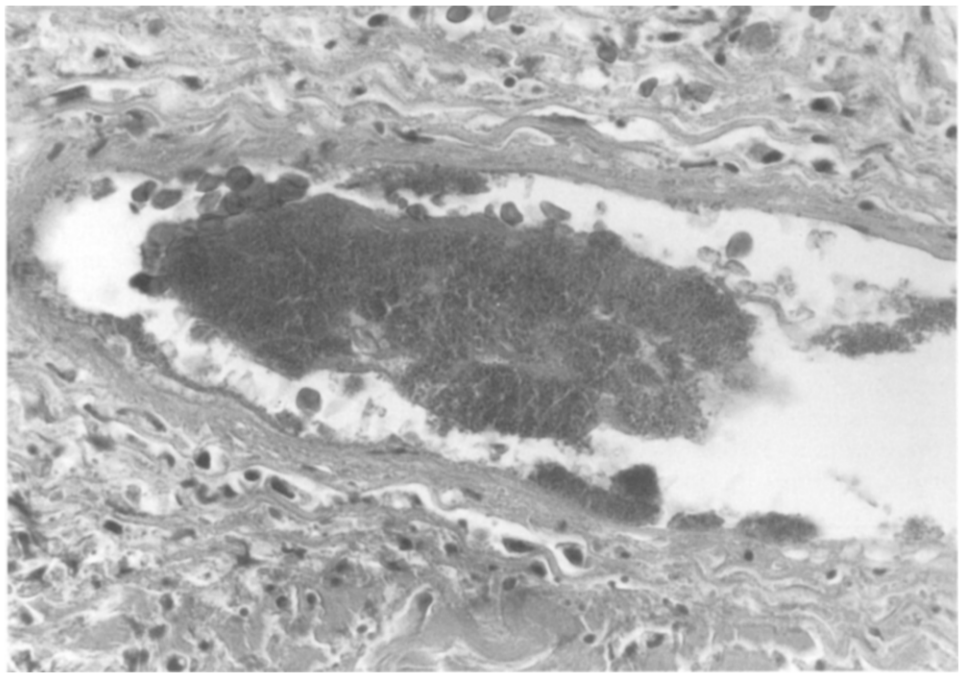

Fig. 3. Photomicrograph demonstrates intraluminal bacterial cloud with periadventitial inflammation. Note bacteria attached to endothelium.

femoral artery resection, an abdominal exploration was performed to remove the right common iliac stent and resect the rest of the right common iliac artery. The stump of the common iliac artery was oversewn flush with the distal aorta with multiple Prolene sutures. The retroperitoneum was intensely inflamed. In the course of dissection, irrepairable venous bleeding was encountered requiring ligation of the inferior vena cava and common iliac veins. The patient continued to have a slow and prolonged recovery in the intensive care unit. Blood cultures became negative, the white blood cell count and renal dysfunction returned to normal, and the tracheostomy was no longer a necessity. Eventually, 2½ months after admission, the patient was transferred to a rehabilitation facility.

In a June 1995 clinic visit, the patient was afebrile and gaining weight. The above-knee amputation incision was well healed and she was learning to use a prosthesis. The

patient will be treated with oral antibiotics (one Bactrim DS daily) indefinitely.

DISCUSSION

The incidence and natural history of prosthetic bypass graft infections are well known.[3-6] Graft infection rates range from 1.3% to 6%. A vascular graft infection is associated with an amputation rate of 15% to 60% and a mortality rate of 10% to 50% depending on graft location.[3,7-9] In contrast, the incidence and consequences of infected arterial stents are not well characterized. There are two reports in the radiology literature of infection associated with iliac artery stents.[1,2]

The first case involved a common iliac artery stent associated with an infected pseudoaneurysm. The patient had symptoms 2 days after stent deployment. Three weeks later, the patient displayed signs of sepsis and oliguria. He then underwent resection of the pseudoaneurysm and axillobifemoral bypass. The organism cultured was *S. aureus.* Dialysis was discontinued 5 days after surgery, and the patient was fit for discharge 4 weeks later. He was noted to be well at the 2-month follow-up. In the second case, the patient underwent left common iliac artery stenting for intimal dissection followed 1 week later by a second and more proximal left common iliac stent. Seven days after the second procedure, the patient was seen with fever, leg pain, and left lower extremity petechiae. Cultures grew *S. aureus* and *S. epidermidis.* Despite resection of the involved artery, the patient died of respiratory failure 12 days after surgery.

In each case the presenting symptoms of iliac stent infection occurred within 1 to 2 weeks of stent placement. These symptoms included groin or leg pain, fever, and petechiae isolated to the stented limb. The clinical syndrome is hallmarked by a rapidly progressive septic course with complications of adult respiratory distress syndrome, liver dysfunction, and renal insufficiency. Early recognition, but preferably prevention, of iliac stent infection is of paramount importance.

In all three cases, *S. aureus* was cultured. *S. aureus* is a common skin flora contaminant and cause of intravascular catheter infection.[10] The early presentation of this organism suggests seeding of the stent and artery at the time of the endovascular procedure. Disruption and fracture of the arterial intima and media during angioplasty may predispose this portion of the artery to seeding by bacteria. Bacteria have also been shown to colonize a stent surface irreversibly and prevent tissue incorporation.[11] In the case presented, the stents did not appear incorporated. Therefore the prevention of bacterial contamination is of supreme importance in preventing iliac stent infection and ensuring tissue incorporation.

Iliac artery stent placement is an invasive procedure. Strict adherence to sterile technique must be emphasized. Breach of sterility may be more frequent in an angiographic suite as opposed to the operating room, where fewer people enter and leave the sterile field. Long guide wires and catheters are also prone to contamination if not handled with care. The use of multiple stents and restenting of the same artery may increase the likelihood of infection. In addition, the use of thrombolytics with prolonged indwelling sheaths or catheters may provide a portal for intravascular infection.

There have been no randomized, prospective trials evaluating the efficacy of prophylactic antibiotics during stent placement. However, given the potential seriousness of stent infection and the experience with prosthetic vascular grafts, we would recommend the use of prophylactic antibiotics before stent deployment. The use of antibiotics during the period when indwelling intravascular sheaths/catheters are in place or around the time of a prolonged (greater than 4 to 6 hours) urokinase infusion should also be given consideration.

In summary, endovascular stent deployment is an invasive procedure and therefore carries a set of defined complications. Stent infection with arterial necrosis is a devastating but rare morbidity. In the last 16 months (January 1, 1994, to April 21, 1995), 93 iliac artery stents have been deployed in 46 patients during 49 angiographic procedures at Loma Linda University Medical Center. This case represents one infection per stent (1.07%), or one infection per procedure (2.04%), because multiple stents were deployed in a number of patients during the procedure. However, this represents a limited experience; the exact incidence of infectious complications after iliac stent deployment is yet to be determined.

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